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# Design Research in Informatics

## A Comment to Iivari

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### 1 Introduction

Juhani Iivari's rich discussion essay about information systems as a design science serves the goal of triggering a debate about research on information systems (IS). The essay is a reflective piece, and the historic approach to IS research taken by Iivari succeeds in opening up for a discussion about several fundamental dilemmas within the informatics field, such as the tension between research and practice, between technological and social aspects, and between the process and the product of design. This kind of discussion is particularly important for the field of IS, which focuses on making changes, and it is important in relation to the changes that are happening right now with web 2.0, mobile technologies and new ways of combining physical and virtual information spaces.

In this commentary I follow up on some of Iivari's points. The structure of my commentary is as follows: I start with being specific about what I think design in informatics is, before I move on to discuss whether it is a science. Next, I follow up some of Iivari's main points by discussing them as basic dilemmas in design. I then discuss research on design in informatics.

### 2 What is Design in Informatics?

Design, basically, is giving material form to an idea. Form-giving involves translations between levels of abstraction and various physical materials (Bratteteig 2004). Design is driven by the vision of an artefact (or product or system) (Bratteteig & Stolterman 1997). If given an idea for an IS, modelling

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is a way of giving form. The model is a description (or a running model acting as a presentation) that becomes the prescription for producing the design result.

But design is more than form-giving: it is also the creation of ideas. Many design researchers write about design as the handling of problematic situations (Schön 1983) and wicked problems (Buchanan 1995) where the process of defining or setting the problem is the main challenge. Participatory design (PD) particularly addresses this part of design assuming that there are different perspectives and interests concerned with defining what the problem is and how it can be solved (Nygaard 1996; Bjerknes et al. 1987). Design ideas should come from the use context as well as from the technical realm (Bratteteig 2004), and PD aims to create synergies between these two areas of practice.

Design as form-giving is also about creating new forms and new materials that give rise to new products—and new ideas. In informatics, the basic material and form are digital and electronic (Löwgren & Stolterman 1998; Blevis et al. 2006; Bratteteig forthcoming 2008). Designers aim to create usable artefacts where the form constitutes the functionality and communicates it to the users. In this way design as form-giving is also a way of communicating an idea in such a way that the user(s) can make sense of the design result. Design is concerned with the aesthetics of the surface as well as the underlying structures of the artefact.

Finally, design is about the making of the process of design (Andersen et al. 1990). Planning the processes of creating ideas and giving form—and the process of production—is also an important aspect of design that influences the selection of ideas and visions as well as materials and forms.

### 3 Is It a Science?

Iivari claims that computer science and IS are design sciences. ‘Design science’ refers to a systematic approach to design, making the design activity itself a scientific activity. In comparison, ‘scientific design’ points to industrial design that is based on scientific knowledge. However, if design includes the generation of ideas and the creation of alternative forms, design cannot be a scientific activity in line with the positivist perspective underlying design science (a discussion which concerns both ontology and epistemology). Schön’s (1983) reflective practice and the handling of different logics or worlds (Bucchiarelli 1984) tell about non-linear and unpredictable processes. The anti-positivist

tivist position maintains that knowledge is never neutral or complete and that the scientist is part of the scientific study.

It makes sense, however, to talk about design as a discipline aimed at developing knowledge about the processes of giving form\*, about the processes of creating ideas, and about the design process as it proceeds from idea to design result. I particularly want to include the broader context of design and use as important for both the design ideas and the material-discursive practices developed during design. The evaluative side of creative activity suggests that we need to add knowledge about the design result. From a PD perspective the design result (the artefact) cannot be understood separate from its use, its use context and its situatedness in time.

## 4 Dilemmas in Design

An anti-positivist understanding of design refers to a different ontology and epistemology than the one described by Iivari, and makes a basis for identifying some basic dilemmas in design that also concern methodology and ethics. Here, I will discuss three basic dilemmas in design that originate in design practice: between design and use, between the human and the machine, and finally between design processes and design results. These dilemmas point to challenges for IS design, and are difficult to handle because they include fuzzy categories and because the relation between them continuously changes.

*The relation between design and use* is fundamental within all design: when designing an artefact, the designers have full control, when the artefact is handed over to the users, the users take control of the artefact and do whatever they want with it. Numerous user studies conclude that users use the same artefact (or system) very differently, and that many features of information systems remain unknown and unused for years. PD is one approach to handling this difficult relationship in that some of the uncertainties concerned with use are moved into the design process. This move introduces new uncertainties in design, but the basic one concerning whether the users will use the artefact as envisioned, is reduced. Approaches like tailoring or producing semi-finished products are other ways of moving design decisions closer to use.

Design and use are intricately related. Design is aimed towards use, and the usefulness and the use practices determine the success of the artefact. The functionality and meaning of the artefact (as seen by the designer) is translated into forms and affordances believed to communicate the functionality and (designer) meaning to the user. The aesthetic aspects of the artefact are always

evaluated against the effect of the form on use, i.e. whether the functionality is communicated well.

Use is always related to the affordances—but not controlled by them. The meaning that a user makes of the artefact as part of her/his environment decides how it is used. Meaning-making is crucial for use. As this meaning-making is done by the users and not the designers, so-called sideeffects or unintended consequences may appear—for good or bad. A good example is how SMS has developed to be the main way of using mobile phones for many people. The habit of constantly texting each other makes the mobile phone have a different meaning for many teenagers as they move in the world of adults maintaining a separate virtual teenage life world with their friends. Texting constitutes the mobile phone as a gate to their social life.

If design is translations of ideas into form, users participate in many ways in design work. It makes sense to apply a life cycle perspective of the design artefact in order to fully understand how design and use are related in the making of meanings in forms.

*The relation between humans and machines* is also fundamental in design, and particularly in IS design. For some years IS researchers have made use of social science theories addressing this relation and emphasizing how human action is influenced by and influencing its environment (see Bratteteig 2004). A human with a pacemaker or a pair of glasses blurs the borders between the human and the artefact. Many teenagers would claim to have the same relation to their mobile as any older person has to his/her pacemaker; as a 'lifemaker' Virtual world habits are translated and transferred to real life situations. Symbolic machinery, like IS, is always constituted by the human users (Bratteteig et al. forthcoming ).

However, some suggest seeing use as an interaction or collaboration between humans and machines, like Dahlbom (1996) in line with Latour (1999). This view makes the relational and situational constitution of artefacts explicit and can add to our understandings of design ideas and choices of design forms. Changes in conditions for meaning-making in the use context directly affect design of artefacts-to-be. Changes in the configurations of humans and artefacts in the use context may cause changes in use practices as well as in design practices (see Suchman 2007).

*The relation between the process and the result of design* is basic to design. Design tends to focus on the process, assuming that a certain quality in the process translates to certain qualities in the result. PD, for instance, is assumed to give more democratic design results—but this might not be the case. In fact, quite undemocratic processes may be the best way to achieve a democratic design result (Bjerknes & Bratteteig 1995). However, the way that the meanings and forms are connected in the design process will to some extent be

reflected in the design result, translated through layers of abstraction and concretization. Understanding the relations between processes of idea making and creation of forms may enable us to achieve more sustainable and ethical design products.

These three dilemmas point to different ontologies, epistemologies, methodologies and ethics of design than the view described by Iivari. It seems less important to categorize design processes and results in boxes (like Iivari's tables 1 and 2) as the same artefact can be a tool and an information source and a game—or any other metaphor from human practices. The use contexts constitute the meaning of the artefact and they change continuously.

## 5 What is Design Research?

Iivari focuses on the relation between design research and design practice. Simply stated, research is systematic inquiry, where the goal of the research activity is to produce knowledge. Research produces knowledge about practice or knowledge that can be realized in practice. Design research aims to develop knowledge about design that contributes to design practice. Design practice aims to develop design results: artefacts, systems and all sorts of products. Design research is therefore concerned with the making of knowledge about design processes, design results and the relations between them. Knowledge about the design process includes what designers do and how, their methods and practices. These topics are covered by design research across design disciplines (Cross 2007). Knowledge about the artefact concerns the characteristics of the design result. In IS we design software: abstraction artefacts that perform operations. We also create the material forms that can represent these abstract symbolic processes to users in the user interface. The characteristics of the digital, electronic material influences what range of artefacts we make as well as the repertoire of forms we make use of. Characterizing design in IS as the making of software crosses characterizations of IS design results concerned with their roles (like a tool) or the activity in which they are used (like a game).

The particular characteristics of the design result refer to the characteristics of the design material and suggests that design research in IS should include knowledge about how to translate ideas and visions into digital electronic forms and how these forms are made meaningful in use. These kinds of knowledges may have to be developed in close relation to design practice: studying how design happens may require to do some design. Design research needs to develop research methods that include design practice as a part of the

research design. Action research is one such approach and includes the changing of (the practices of) the research site as a goal of the research activity (Elden & Levin 1991). Action research thus has two goals for the one activity: to make a change in an organisation together with the people there, and to make knowledge about that type of change. An empirical approach to design research could include doing design as a part of researching that design process, but if the aim does not include a change beyond the design result this is different from action research.

Iivari raises the question about what kind of knowledge we get from empirically oriented case-based research like action research. My view on design as forming and meaning-making suggests that design knowledge should include more than methods and artefacts in isolation: the important knowledge is concerned with how the processes of translation and meaning-making unfold, and how the forming interacts with the meaning-making.

Different research approaches give us answers to different types of research questions. Kalleberg (1992) suggests distinguishing between different research designs by the questions, answers, concepts and data brought forward. He suggests three basic types of research designs asking different types of questions: constative (how and why something is the way it is), evaluative (the value of a social reality), and constructive (what a set of actors can and should do to change a particular social reality for the better) which can be interventionist (classic action research), variational (a number of good examples) or imaginative (utopian, like many of the Scandinavian trade union projects in the 1970s and 1980s). In constructive research we look for the particular as a source for generating general insights, changing the concept of 'generalization' from something typical, which actually exists to something unique and wanted—avant-garde or demonstrative of a wanted change (Bratteteig 2004, p. 49).

Marshall & Rossman (1989) suggest the concepts of credibility, confirmativity, transferability and dependability as alternatives to the positivist terms: validity (internal and external), reliability, generalization and objectivity. These alternative concepts open up for seeing research as a human activity not assuming any impossible (positivist) objective accounts of the world.

## 6 Concluding Remarks

Iivari's discussion piece succeeds in evoking engagement in discussing important challenges in IS research. Interestingly, the essay is both subjective and emotional and it contributes to the discussion about research—a fact that

warms the heart of an anti-positivist participatory design researcher like myself. I disagree with Iivari's view on what IS design is about, which leads me to disagree with him in most of what he chooses to see as ontological, epistemological, methodological and ethical questions. I particularly find no reason to 'scientise' design by focusing on design methods and formalisms—as in Simon's (1969) outline of a 'science of the artificial' (see Cross 2007). This way of 'scientising' design seems to offer little support for understanding design, not even the engineering part. However, I do think that IS research will benefit from seeing IS design as a design discipline in line with other design disciplines. We should invite other design disciplines to share and compare their ways of knowing and working when giving form and making meaning with our ways of designing digital electronic artefacts, systems and products.

I do find design research important for gaining a better understanding of IS design. Research on design in IS needs to build knowledge about the forming and meaning-making of digital materials (software and hardware) as well as about the work that goes on in a use context when users habituate a new artifact. It seems unethical to leave out any one of these knowledge areas. The challenges of balancing design and use, humans and machines, and process and product encourage a multidisciplinary approach to research on IS design, and suggest inclusion of many different sciences in our theoretical and methodological repertoire. The Scandinavian IS research community has a long tradition in doing just that.

## Notes

1. What Cross (2007) calls "designerly ways of knowing"

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## References

- Andersen, N.E., Kensing F., Lassen M., Lundin, J., Mathiassen, L., Munk-Madsen, A., and Sørgaard P., *Professional Systems Development – Experiences, Ideas, and Action*, Upper Saddle River, NJ, Prentice-Hall, 1990.
- Barad, K., *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Duke University Press, 2007.
- Bjerknes, G., and Bratteteig T., *User Participation and Democracy. A Discussion of Scandinavian Research on System Development*, Scandinavian Journal of Information Systems, 7(1), 1995, pp.73-98.
- Bjerknes, G., Ehn, P., and Kyng, M., (eds.) *Computers and Democracy*, Aldershot, Avebury, 1987.
- Blevins, E., Kim Y., and Stolterman, E., “Regarding Software as Material of Design,” *Wonderground*, Lisbon, Portugal. Design Research Society, 2006.
- Bratteteig, T., *Making Change. Dealing with relations between design and use*, Dr.Philos dissertation, Department of Informatics, University of Oslo, 2004.
- Bratteteig, T., “A Matter of Digital Materiality,” in I. Wagner, T. Bratteteig, D. Stuedahl (eds.), *Exploring Digital Design*, Springer Verlag, forthcoming 2008.
- Bratteteig, T and Stolterman E., “Design in groups—and all that jazz,” M. Kyng, and L. Mathiassen (eds.), *Computers and Design in Context*, Cambridge, Massachusetts, MIT Press, 1997, pp. 289-316.
- Bucciarelli, L.L., *Designing Engineers*, Cambridge, Massachusetts, MIT Press, 1994.
- Buchanan, R., “Wicked Problems in Design Thinking,” in *The Idea of Design*, R. Buchanan and V. Margolin (eds.), Cambridge, Massachusetts, MIT Press, 1995, pp. 3-20.
- Cross, N., *Designerly ways of Knowing*, London: Springer Verlag.
- Dahlbom, B., “The new informatics,” *Scandinavian Journal of Information Systems*, 8(2), 1996, pp. 29-48.
- Elden, M. and Levin M., “Cogenerativ learning: Bringing Participation into Action Research,” in *Participative Action Research*, W.F. Whyte, (ed.), Beverly Hills, Sage, 1991, pp.127-142.
- Kalleberg, R., *Konstruktiv samfunnsvitenskap. En fagteoretisk plassering av ‘aksjonsforskning’*, Department of Sociology Report (24), University of Oslo, 1992.

- Latour, B., *Pandora's Hope: Essays on the Reality of Science Studies*, Cambridge, Massachusetts, Harvard University Press, 1999.
- Löwgren, J., and Stolterman, E., *Design av informationsteknik – materialet utan egenskaper*, Studentlitteratur, Lund, 1998.
- Marshall, C., and Rossman, G.B., *Designing Qualitative Research*, Newbury Park, CA, Sage, 1989.
- Nygaard, K., "Those Were the Days? Or Heroic Times Are Here Again?," *Scandinavian Journal of Information Systems*, 8 (2), 1996.
- Schön, D., *The Reflective Practitioner: How Professionals Think in Action*, Basic Books, New York, 1983.
- Simon, H., *The Sciences of Artificial*, Cambridge, Massachusetts, MIT Press, Cambridge University Press, 1969.
- Suchman, L., *Human-Machine Reconfigurations: Plans and Situated Actions, 2nd expanded edition*, Cambridge University Press, New York and Cambridge, UK, 2007.

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